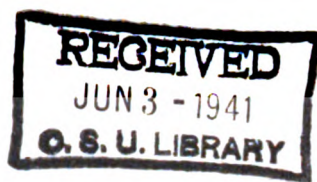


I. C. 7163



APRIL 1941

UNITED STATES
DEPARTMENT OF THE INTERIOR
HAROLD L. ICKES, SECRETARY

BUREAU OF MINES
R. R. SAYERS, DIRECTOR

INFORMATION CIRCULAR

EXPLOSIONS IN ALABAMA COAL MINES



BY

FRANK E. CASH

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UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

EXPLOSIONS IN ALABAMA COAL MINES^{1/}

By Frank E. Cash^{2/}

INTRODUCTION

Compared with accident records of other coal-mining States, Alabama's experience with gas and dust ignitions and explosions is not good, although the reduction in accidents and disasters from these causes has been marked.

From 1894 to 1940, inclusive, 1,058 fatalities (approximately 23 per cent of all Alabama coal-mine fatalities) were caused by fires and ignitions or explosions of gas and dust.

A definite decrease in fatalities from these causes is shown by the following data for 10-year periods, beginning with 1901, when keeping accurate records of fatalities in mines was begun: 1901 to 1910, 380 fatalities; 1921 to 1930, 259 fatalities; and 1931 to 1940, 46 fatalities.

This reduction in the number of fatalities from the causes mentioned has been realized through the combined efforts of the operators, the employees, the Division of Safety and Inspection of the Alabama Department of Industrial Relations, and the Federal Bureau of Mines. However, Alabama still has far too many fatalities from gas and dust ignitions and explosions that can and should be reduced.

This report is a revision and extension of Information Circular 6352, published in 1930.^{3/}

FIRES, GAS IGNITIONS, AND EXPLOSIONS

Table 1, listing the fires, gas ignitions, and explosions in which one or more persons were killed from 1894 to 1940, was compiled from data obtained from operators and State and Federal agencies.

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- 1/ The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Information Circular 7163."
- 2/ District engineer, Bureau of Mines Safety Station, U. S. Department of the Interior, Birmingham, Ala.
- 3/ Cash, F. E., and Humphrey, H. B., Explosions in Alabama Coal Mines: Bureau of Mines Inf. Circ. 6352, 1930, 3 pp.

TABLE 1. - Fires, gas ignitions, and explosions in Alabama coal mines, 1894-1940

Date	Mine	Type	Cause	Number Killed
1894 2/15	Blocton No. 2	Fire	Spontaneous combustion	1
1895 2/24	No. 1 slope	Gas	Blown-out shot	2
1895 3/16	Sumter	do.	Ignited by open light	1
1895 4/4	Coalburg	do.	do.	1
1895 7/9	No. 1 slope	Gas explosion	Open light	1
1897 3/24	Blocton No. 2	Gas	Blown-out shot	4
1897 9/20	Belle Ellen	Fire	Open light	5
1898 3/19	No. 2 slope	Gas explosion	do.	6
1898 5/26	Hargrove	do.	do.	2
1898 8/15	New Castle	do.	do.	2
1899 2/21	Blocton No. 2	do.	Blown-out shot	5
1899 3/9	Patton No. 2	do.	do.	1
1900 4/13	Hargrove	do.	Ignited by open light	1
1900 8/10	do.	Gas suffocation	do.	1
1900 9/25	do.	Gas	do.	1
1901 5/6	Johns	do.	do.	1
1901 7/27	Zenida	Gas explosion	do.	1
1902 1/2	Searles	Dust explosion	Blown-out shot	1
1902 2/3	Little Creek	do.	do.	1
1902 3/3	Warrior No. 2	Gas and dust explosion	do.	1
1905 2/20	Virginia	do.	do.	108
1906 2/27	Piper No. 2	Dust explosion	do.	12
1907 7/11	Palos No. 3	Gas explosion	Open light	1
1907 10/4	Pratt No. 7	do.	do.	3
1907 12/16	Yolande No. 1	Gas and dust explosion	do.	57
1907 12/28	Mulga	Gas	Ignited by open light	1
1908 2/8	Blocton	do.	do.	1
1908 2/13	Belle Ellen	do.	do.	1
1908 2/14	Banner	do.	do.	2
1908 5/29	Pratt No. 2	do.	do.	1
1908 6/24	Banner	Dust explosion	Blown-out shot	1
1908 8/24	Elvira	Gas explosion	Open light	1
1908 9/1	Blossburg	do.	do.	3
1908 10/26	Short Creek	Dust explosion	Blown-out shot	6
1908 11/16	Pratt No. 3	Fire suffocation	Built wood fire	8
1908 12/30	Blocton	Dust explosion	Blown-out shot	3
1909 1/4	Coalmont	Gas	Ignited by open light	1
1909 1/12	Elvira	do.	do.	1
1909 2/2	Short Creek	Dust explosion	Blown-out shot	18
1909 5/13	Burnwell	Gas	Ignited by open light	2
1909 10/5	Yolande No. 1	Gas explosion	Open light	3
1909 12/29	Coleanor	do.	do.	1
1910 1/3	New Connells-ville	do.	do.	2
1910 4/14	Docena	do.	do.	1
1910 4/20	Mulga	Gas and dust explosion	do.	40

TABLE 1. - Fires, gas ignitions, and explosions in Alabama coal mines, 1894-1940 (cont'd.)

Date	Mine	Type	Cause	Number Killed
1910 5/5	Palos No. 3	Gas and dust explosion	Black powder	90
1910 9/21	Belle Ellen	Gas explosion	Open light	1
1910 11/3	Yolande	Gas and dust explosion	Blown-out shot	5
1910 12/8	Dolomite	Gas explosion	do.	1
1911 4/8	Banner	Gas and dust explosion	Open light	128
1911 7/2	Coleanor	Gas explosion	do.	1
1911 8/28	Blue Creek	do.	do.	1
1912 4/14	Hargrove	do.	do.	1
1912 4/29	Marvel No. 2	do.	do.	1
1912 7/2	Belle Jay	do.	do.	1
1912 7/9	Margaret No. 1	do.	do.	1
1912 8/13	Abernant	Gas and dust explosion	do.	18
1912 9/8	Great Elk	Gas explosion	do.	1
1912 10/5	Belle Ellen	do.	do.	1
1912 10/6	Banner	do.	do.	1
1912 12/20	Margaret No. 1	Gas	Ignited by open light	1
1913 3/24	Indio	do.	do.	3
1913 11/18	Action No. 2	Gas and dust	Ignited by black-powder shot	24
1914 1/10	Rock Castle	Gas and dust explosion	Open light	12
1914 4/16	Piper No. 2	Gas	Ignited by open light	2
1914 8/14	Edgewater	do.	do.	1
1914 9/8	Piper No. 2	do.	do.	1
1914 10/5	Mulga	do.	do.	17
1914 10/31	Coleanor	do.	do.	3
1914 11/2	Acmar	do.	do.	1
1915 4/23	Aldrich	Gas explosion	Open light	4
1915 7/27	Piper No. 2	Gas ignition	do.	1
1915 9/11	Banner	Gas explosion	do.	2
1916 1/26	Edgewater	do.	Ignited by black-powder shot	1
1916 4/1	Aldrich	do.	Ignited by open light	1
1916 4/24	Johns	do.	do.	1
1916 5/13	Belle Ellen No. 2	do.	do.	1
1916 6/15	Coalmont No. 2	Dust explosion	Blown-out shot	2
1916 10/22	Marbel No. 2	Gas and dust explosion	Electric arc, knife switch	18
1916 11/4	Bessie	do.	Open light	30
1917 1/7	Palos No. 3	Gas explosion	do.	1
1917 2/9	Galloway No. 11	do.	do.	1
1917 6/13	Banner	Gas and dust explosion	do.	6
1917 7/11	New Castle No. 2	Gas explosion	do.	1
1917 8/2	Belle Ellen No. 2	do.	do.	2

TABLE 1. - Fires, gas ignitions, and explosions in Alabama coal mines, 1894-1940 (cont'd.)

Date	Mine	Type	Cause	Number Killed
1917 10/6	Marvel No. 2	Gas explosion	Open light	1
1918 4/3	Bayview	Gas and dust explosion	do.	2
1918 7/6	Margaret No. 1	Gas	Ignited by open light	3
1918 9/20	Wylam No. 8	Gas explosion	Open light	2
1918 10/30	Townley No. 2	do.	do.	1
1918 12/14	Klondike	CO ₂	Suffocation	1
1919 2/7	Acmar No. 3	Gas and dust explosion	Open light	1
1919 4/29	Majestic	do.	do.	22
1919 11/29	Belle Ellen No. 2	Gas explosion	do.	1
1920 3/1	Margaret No. 2	do.	do.	1
1920 11/23	Parrish	do.	do.	12
1921 3/10	Acmar No. 3	do.	do.	1
1921 12/19	Acmar No. 2	do.	do.	1
1921 12/31	Docena	do.	do.	5
1922 2/2	Belle Ellen No. 2	do.	do.	9
1922 3/21	Whites	Gas	Suffocation	1
1922 5/25	Acmar No. 3	Gas and dust explosion	Open light	11
1922 10/9	Marvel No. 2	Gas explosion	do.	1
1922 11/22	Dolomite No. 3	Dust explosion	Electric arc	90
1923 1/10	Dolomite No. 1	Gas explosion	Open light	5
1923 9/13	Piper No. 2	do.	do.	1
1923 11/12	Dixie	do.	do.	2
1924 7/14	Risco	do.	do.	1
1924 10/13	Wylam	do.	do.	1
1925 2/2	Calumet No. 2	Gas	Ignited by open light	1
1925 5/31	Piper No. 2	Gas explosion	Opening fire seals	7
1925 7/6	Straven	do.	Open light	1
1925 8/24	Acmar No. 3	do.	do.	1
1925 8/27	Dogwood	do.	do.	2
1925 8/28	Coleanor	do.	do.	1
1925 9/8	Helena Straven	do.	do.	1
1925 12/10	Overton No. 2	Gas and dust explosion	do.	53
1926 1/29	Mossboro	Dust explosion	Blown-out shot (black powder)	27
1926 6/10	Majestic	Gas explosion	Open light	4
1926 7/21	Dixie	do.	do.	9
1926 12/19	Dixiana	do.	do.	1
1927 6/3	Flat Top	do.	do.	1
1927 10/18	Coleanor	do.	do.	1
1927 11/18	New Castle No. 2	Gas and dust explosion	do.	1
1929 1/12	Powhatan	Gas explosion	do.	1
1929 5/27	Connellsville	Gas and dust explosion	Electric arc-hoist	10
1929 10/14	Gamma	Gas explosion	Open light	1

TABLE 1. - Fires, gas ignitions, and explosions in Alabama coal mines, 1894-1940 (cont'd.)

Date	Mine	Type	Cause	Number Killed
1930 1/13	Peerless	Gas and dust	Mining machine	7
1930 8/7	Marvel No. 2	Gas	Open carbide light	1
1931 12/29	Overton No. 1	do.	Mining machine	3
1933 8/11	Bankhead No. 1	do.	Open carbide lamp	1
1934 1/9	Aldrich	Gas and dust	Mining machine	2
1937 10/14	Mulga	do.	Open flame, safety lamp	34
1938 6/10	Boothton No. 1	Gas	Mining-machine motor	3
1939 9/7	Franklin	do.	Open light	1
1940 8/19	Piper No. 2	do.	Match	1

The causes of the accidents listed are given as nearly as could be determined. In most instances the causes are well-established, especially as regards explosions falling under the head of major disasters in which five or more persons were killed. (See table 2.)

TABLE 2. - Major disasters in Alabama coal mines, 1894-1940

Date	Mine	Killed			Type	Origin
		Flame - violence	Gas	Total		
1897	Belle Ellen	-	5	5	Fire	Open light
1898	No. 2. Slope	-	-	6	Gas explosion	do.
1899	Blocton No. 2	-	5	5	do.	Blown-out shot
1905	Virginia	-	-	108	Gas and dust	do.
1906	Piper No. 2	-	-	12	Dust explosion	do.
1907	Yolande No. 1	-	-	57	Gas and dust	Open light
1908	Short Creek	-	-	6	Dust explosion	Blown-out shot
1908	Pratt No. 3	-	8	8	Fire	Built wood fire
1909	Short Creek	-	-	18	Dust explosion	Blown-out shot
1910	Mulga	-	-	40	Gas and dust	Open light
1910	Palos No. 3	-	-	90	do.	Blown-out shot
1910	Yolande	-	-	5	do.	do.
1911	Banner	64	64	128	do.	Open light
1912	Abernant	-	-	18	do.	do.
1913	Acton No. 2	13	11	24	do.	Blown-out shot
1914	Rock Castle	4	8	12	do.	Open light
1914	Mulga	1	16	17	Gas explosion	do.
1916	Marvel No. 2	6	12	18	Gas and dust	Electric arc
1916	Bessie	16	14	30	do.	Open light
1917	Banner	-	6	6	do.	do.
1919	Majestic	12	10	22	do.	do.
1920	Parrish	9	3	12	Gas explosion	do.
1921	Docena	3	2	5	do.	do.
1922	Belle Ellen No. 2	6	3	9	do.	do.
1922	Acmar No. 3	11	-	11	Gas and dust	do.
1922	Dolomite No. 3	60	30	90	Dust explosion	Electric arc

TABLE 2. - Major disasters in Alabama coal mines, 1894-1940 (cont'd.)

Date	Mine	Killed			Type	Origin
		Flame - violence	Gas	Total		
1923	Dolomite No. 1	5	-	5	Gas explosion	Open light
1925	Piper No. 2	7	-	7	do.	Opening fire seals
1925	Overton No. 2	24	29	53	Gas and dust	Open light
1926	Mossboro	10	17	27	Dust explosion	Blown-out shot
1926	Dixie	9	-	9	Gas explosion	Open light
1929	Connellsville	7	3	10	Gas and dust	Electric arc
1930	Peerless	7	-	7	do.	Mining machine
1937	Mulga	-	-	34	do.	Open flame, safety lamp

Of the 136 fires, ignitions, and explosions listed, 99 (73 percent) were due to the ignition of methane and caused 202 deaths; 10 (7 percent) resulted from the explosion of suspended dust and caused 161 deaths; 23 (17 percent) were due to combined gas and dust explosions and caused 680 deaths; and 4 (3 percent) were due to fires and carbon monoxide and caused 15 deaths. (See table 3.)

TABLE 3. - Fires and explosions in Alabama coal mines, by type

Type	All explosions				Major disasters			
	Ignitions	Deaths	Percentage		Ignitions	Deaths	Percentage	
			Ignitions	Deaths			Ignitions	Deaths
Gas	99	202	73	19	9	75	27	8
Dust	10	161	7	16	5	153	15	17
Gas and dust	23	680	17	64	18	673	53	74
Fires	4	15	3	1	2	13	5	1
Total	136	1,068	100	100	34	914	100	100

From the summary in table 3 it is evident that enough methane to kill the man or men who ignite it and very often others nearby has accumulated frequently. "Local gas ignitions" were potentially major disasters, even when not enough dust was raised to propagate an explosion where rock-dusting had not been done. Explosions of dust alone have been relatively few, but owing to their nature they have been considerably more destructive than those from methane alone. Only one dust explosion has occurred in the past 18 years, and this was in a mine using black blasting powder, shooting off the solid, and not rock-dusted. Of the 99 gas explosions that did not involve dust, only 9 were major disasters (each resulting in the death of 5 or more); of the 10 due to dust with resultant 161 fatalities, 5 were of the major type with 153 deaths. The deadly combination of gas and dust caused 680 deaths (64 percent of the total); about 80 percent of these explosions were classes as major disasters.

The fires, ignitions, and explosions are listed in table 4 according to origin.

TABLE 4. - Fires and explosions in Alabama coal mines, by origin

Origin	All explosions				Major disasters			
	Ignitions	Deaths	Percentage		Ignitions	Deaths	Percentage	
			Ignitions	Deaths			Ignitions	Deaths
Open lights..	105	595	77	56	19	479	56	52
Explosives...	20	313	15	29	9	295	27	32
Electricity..	7	133	5	13	4	125	12	14
Miscellaneous	4	17	3	2	2	15	5	2
Total....	136	1,058	100	100	34	914	100	100

Open lights, commonly used in this district until the last few years, have been responsible for the origin of about 77 percent of the ignitions and explosions and of more than half of the fatalities from them. Open lights, including attempts to relight disassembled flame safety lamps, were responsible for 56 percent of the major disasters and 51 percent of the fatalities due to them. Ignitions by open lights are gradually but surely decreasing owing to the more general use of electric cap lamps; no ignitions have been caused by electric cap lamps.

Over the long period, explosives (frequently blown-out shots) were second, with 29 percent of the fatalities and 15 percent of the ignitions. As a result of the marked increase in the use of permissible explosives, the gradual increase in the use of electric blasting, and the general increase in cutting the coal with machines an ignition has not been recorded from this source since 1926. Insofar as can be determined the explosions caused by explosives were due to black blasting powder or dynamite, and in no known instance have permissible explosives been involved directly. Electricity has not played as prominent a part in mine explosions in this district as in those of other States where it is in more general use. Mines equipped with extensive electric machinery (in Alabama, ordinarily) use rock dust and water and usually are ventilated adequately. However, there were three ignitions from electricity 1894 to 1929, and from 1930 to 1940, inclusive, there have been four.

As more machinery and electric power are used in the mines of the State greater care must be exercised to keep explosive mixtures of methane and air and sources of ignition apart if explosions are to be avoided. Constant and effective ventilation must be maintained at the faces; standards of frequent inspection for explosive gas must be followed rigidly; rock-dusting and wetting of fines must be part of daily routine operating practice; blasting must be done with **permissible explosives in a permissible manner**; and where gas is likely to accumulate only permissible mining equipment, including electric cap lamps, should be used.

CONCLUSIONS

Explosions of all kinds in the coal mines of Alabama as well as in those of any other State are preventable to the extent that precautions are adopted and

maintained to eliminate them. If provision is made against widespread explosion only local ignitions will occur; and, with the concentrated methods of mining, where men are now working in considerable numbers relatively short distances apart, these local ignitions are very likely to result in multiple deaths. Adequate ventilation, properly coursed, frequent and careful inspection, and proper removal of gas will obviate virtually all ignitions if open lights and smoking and open types of electric equipment are not allowed in coal mines and if due care is taken in the utilization of flame safety lamps.

Permissible electric equipment, properly maintained and operated, permissible explosives permissibly handled, and efficient methods of ventilating, watering, and rock-dusting are necessary if certain types of explosions from coal mines are to be prevented. To operate coal mines, especially mines that give off explosive gas, without such safety measures is deliberately taking the chance of losing the lives of all persons in the mine, as well as of causing enormous damage to property.